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## **CHAPTER 7**

### **CONCRETE**

#### **7.00.00 INTRODUCTION**

#### **7.01.00 GENERAL**

This specification enumerates the requirements for the materials, storage, transportation, measuring, mixing, placing, and curing of Portland cement concrete. This specification applies to all Portland cement concrete used in sidewalks, driveways, approaches, patches, manholes, inlets, and other structures constructed in the City of Delta. Engineering plans, licenses, permits, inspection, warranty, and acceptance shall be as detailed in these STANDARDS AND SPECIFICATIONS for the applicable type of construction involved. Permits shall be obtained before work begins. The Responsible Party shall contact the City twenty-four (24) hours in advance of concrete placement when the formwork is ready to receive the concrete. Where required, compaction test results shall verify the adequacy of all ground upon which concrete is to be placed. All work performed according to this section must comply with the general requirements contained within Chapter 1 and the acceptance requirements of Chapter 10.

#### **7.10.00 DESIGN STANDARDS**

Design criteria for the various elements using concrete are specified in other chapters of this document. Design specifications for sidewalks, curb and gutter, driveways, inlets and sidewalks are in Chapter 6 - Roadway. Design specifications for concrete pipe, manholes, inlets, and other drainage and wastewater concrete structures are in Chapter 3 - Water System, Chapter 4 - Sanitary Sewer and Chapter 5 - Storm Sewer. Design specifications relative to traffic control items are in Chapter 8 - Traffic Control.

#### **7.11.00 PLACING CONCRETE**

##### **7.11.01 Preparation**

Before depositing concrete, debris shall be removed from the space to be occupied by the concrete and the forms. Concrete shall not be placed until all forms and reinforcing steel have been inspected and approved by the City Representative. The soil receiving the concrete shall be moist, but not wet, and shall not contain frost or frozen material.

##### **7.11.02 Timing**

Concrete that has developed initial set or does not have workable consistency shall not be used. Concrete shall be continuously mixed or agitated from the time the water is added until the time of use, and shall be completely discharged from the truck mixer or truck agitator within one-and-one-half (1-1/2) hours after it comes in contact with the mixing water or with the aggregates. Retempered concrete will not be allowed.

##### **7.11.03 Concrete Temperature**

At the time of concrete placement, the mix temperature shall be between fifty degrees Fahrenheit (50°F) and ninety degrees Fahrenheit (90°F). In cold weather (see Section 7.11.06), aggregates and water may be heated as part of the batching operation but they shall not be heated beyond a temperature of one-hundred-and-fifty degrees Fahrenheit (150°F). Aggregates shall not be heated directly by gas or oil flame or on sheet metal over direct flame. Materials containing frost or lumps of frozen material shall not be used in the mix, and their presence in the concrete shall be cause for rejection of that batch.

#### **7.11.04 Handling**

- (A) Concrete shall be handled from the mixer to the place of final deposit as rapidly as possible by methods that prevent separation or loss of ingredient. The concrete shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling. Concrete shall be deposited in continuous layers, the thickness of which generally shall not exceed twelve inches (12"). Concrete shall be placed in one continuous operation, except where keyed construction joints are shown on the plans or as approved by the City Representative. Delays in excess of thirty (30) minutes may require removal and replacement of that pour, as determined by the City Representative.
- (B) Concrete shall be placed in a manner that will avoid segregation and shall not be dropped freely more than five feet (5'). If segregation occurs, the City Representative may require the concrete to be removed and replaced at the Responsible Party's expense. Necessary hand spreading shall be done with shovels and not with rakes.
- (C) Concrete shall be thoroughly compacted or vibrated. All concrete shall be compacted by internal vibration using mechanical vibrating equipment, except that concrete in floor slabs, sidewalks, or curb and gutter, not poured against form linings, shall be either tamped or vibrated. Care shall be taken in vibrating the concrete to vibrate only long enough to bring a continuous film of mortar to the surface. Vibration shall stop before any segregation of the concrete occurs. Mechanical vibrators shall be an approved type as specified in ACI Publication 309, Chapter 5. Vibrators shall not be used to move or spread the concrete. Any evidence of lack of consolidation or over consolidation will be regarded as sufficient reason to require the removal of the section involved and its replacement with new concrete at the Responsible Party's expense. The Responsible Party shall be responsible for any defects in the quality and appearance of the completed work.

#### **7.11.05 Workability**

The consistency of concrete shall be kept uniform for each class of work and shall be checked by means of a slump test or Kelly ball tests. The workability of the concrete will be varied as directed by the City Representative. At all times, concrete shall have a consistency such that it can be worked into corners and angles of the forms and around joints, dowels, and tie bars by the construction methods which are being used without excessive spading, segregation, or undue accumulation of water or laitance on the surface. If, through accident, intention, or error in mixing, any concrete that fails to conform to the proportions of the approved mix design, such concrete shall not be incorporated in the work but shall be discarded off the project site as waste material at the Responsible Party's expense. **NO WATER MAY BE ADDED AT THE JOB SITE WITHOUT PERMISSION OF THE CITY REPRESENTATIVE.** If approval is obtained and water is added at the job site, slump tests shall be run and test cylinders cast following the addition of the water. Any expense incurred in excess of ordinary tests will be borne by the Responsible Party.

#### **7.11.06 Weather Restrictions**

- (A) Hot Weather:

Except by written authorization, concrete will not be placed if the temperature of the plastic concrete cannot be maintained at ninety degrees Fahrenheit (90°F) or lower. The placement of concrete in hot weather shall comply with ACI 305. Refer also to Section 7.11.03 of these STANDARDS AND SPECIFICATIONS.

- (B) Cold Weather:

During extreme weather conditions, placing of concrete will be permitted only when the temperature of the concrete placed in the forms will not be less than sixty degrees Fahrenheit (60°F), nor more than ninety degrees Fahrenheit (90°F). To maintain this temperature range, the Responsible Party shall provide acceptable heating apparatus for heating the aggregates and the water. Concrete slabs shall not be placed, regardless of temperature conditions, if the supporting ground is frozen or contains frost. Use of salt or other additives to prevent concrete from freezing will not be allowed. Concrete, which has been frozen, shall be completely removed and replaced as directed by and to the satisfaction of the City Representative.

Concrete may be placed when the air temperature in the shade is at least forty degrees Fahrenheit (40°F) and rising. No concrete shall be placed, regardless of the present temperature, when the weather forecast promises freezing weather before final set of the concrete unless special means of heating and protection are used. Protection against freezing is the Responsible Party's responsibility regardless of the weather forecast or climatic conditions at the time of placing. During cold weather conditions, concrete less than seventy-two (72) hours old shall be protected, at a minimum, as follows:

TABLE 7.11.06

<u>Forecast Low Temperature (by the National Weather Service)</u>	<u>Protection</u>
Between 40 and 32 Degrees	One layer of commercial insulation material.
Between 31 and 25 Degrees	Two layers of commercial insulation material.
Below 25 Degrees	Tenting and heating for a minimum of seven (7) days.

These coverings must remain in place until the concrete is at least five (5) days old.

#### **7.11.07 Jointing**

(A) Expansion Joints:

Expansion joint material shall be provided at the following locations and shall be in place prior to the placing of concrete:

1. Between new concrete and existing masonry buildings or existing concrete.
2. As shown on the drawings
3. At a minimum 100' spacing or as directed by the City Representative

(B) Contraction Joints:

Transverse joints shall be placed at maximum intervals of ten feet (10') to control random cracking. Joints shall be formed, sawed, or tooled to a minimum depth of one-third (1/3) of the total thickness, but no less than 0.5 inches. Contraction joints shall be placed as follows:

1. Not more than ten feet (10') nor less than six feet (6') apart in curb and gutter and combination curb-walk.
2. Not more than the walk width in non-monolithic concrete sidewalk.

3. At least two joints equally spaced at not greater than ten-foot (10') intervals as applicable in driveways.
4. As approved and shown on the plans for special concrete structures.

#### **7.11.08 Finishing and Curing**

In addition to the curing techniques unique to hot and cold weather placement, adequate attention shall be given to finishing and curing the fresh concrete. Exposed faces of curbs and sidewalks shall be finished to true line and grade, as shown on the plans. The surface shall be floated to a smooth, but not slippery, finish. The addition of surface water to assist in the finishing process is prohibited. Sidewalk and curb shall be broomed or combed and edged, unless otherwise indicated by the City Representative. After completion of brooming and before concrete has taken its initial set, all edges in contact with the forms shall be tooled with an edger having a three-eighths-inch (3/8") radius. No dusting or topping of the surface or sprinkling with water to facilitate finishing will be permitted.

Immediately following the removal of the forms, all fins and irregular projections shall be removed from all surfaces except from those which are not to be exposed or are not to be waterproofed. On all surfaces cavities produced by form ties, honeycomb spots, broken corners or edges, and other defects shall either be thoroughly cleaned, moistened with water, and carefully pointed and trued with a mortar consisting of cement and fine aggregate or removed and replaced at the direction of the City Representative. The surface shall be left sound, smooth, even, and uniform in color. Mortar used in pointing shall not be more than thirty (30) minutes old. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.

Fresh concrete shall be adequately protected from weather damage and mechanical injury during the curing periods. The selected curing process shall be started as soon as it can be done without injury to the concrete surface. The use of a membrane-curing compound is recommended. The following curing procedures may be used subject to the approval of the City Representative.

##### **(A) Wet Burlap Curing:**

After completion of the finishing operations, the surface of the concrete shall be entirely covered with burlap mats. The mats used shall be in such length or width that as laid they will extend at least twice the thickness of the concrete beyond the edges of the slab or structure. They shall be placed so that the entire structure and all edges of the concrete, when forms are removed, are completely covered. This covering shall be placed as soon as the concrete has set sufficiently to prevent marring of the surface. After being placed, the mats shall be thoroughly saturated with water by spraying with a mist spray. The burlap shall be so placed and weighted down so it remains in contact with the surface covered, and the covering shall be maintained fully wetted and in position for seven (7) days after the concrete has been placed. If it becomes necessary to remove the burlap for any reason, the concrete shall not be exposed for a period of more than one-half (1/2) hour. This method of curing shall not be used when the outside air temperature is below thirty-two degrees Fahrenheit (32°F) unless heated enclosures are provided.

##### **(B) Plastic Sheet Curing:**

As soon after the completion of the finishing operation as the concrete has set sufficiently to prevent marring of the surface, the top surface and sides shall be entirely covered with plastic sheet materials. The plastic sheet as prepared for use shall have such dimensions that each unit as laid will extend beyond the edges of the concrete at least twice the

thickness of the concrete. The units as used shall be lapped at least twelve inches (12"), and the laps of plastic sheet shall be secure such that they do not open up or separate. The plastic shall be placed and weighted so it remains in contact with the surface covered, curing the entire curing period of seven (7) days.

(C) Waterproof Paper Curing:

The procedures used for plastic sheet curing shall be used when waterproof paper is used in curing concrete.

(D) Liquid Curing Membrane:

Immediately after the surface water has disappeared from the concrete surface, the liquid membrane curing compound (white pigmented) shall be sprayed under pressure to the concrete surface at a rate not less than one (1) gallon per one-hundred-fifty (150) square feet with a spray nozzle, or nozzles, so it covers the entire pavement with a uniform water-impermeable film. If the forms are removed within seven (7) days, the exposed sides and edges shall be sprayed in the above-described manner or the backfill completed immediately.

(E) Insulation Pad:

Insulation pads or other thermal devices may be used to protect concrete in cold weather.

(F) Wax base and resin base solutions shall not be used if linseed oil protection is to be applied to the concrete surface. If linseed oil protection is to be utilized, the method of curing shall be either linseed oil base-curing compound, wet burlap, plastic sheet, or waterproof paper curing.

#### **7.11.09 Testing of Concrete**

When testing is required, the requirements of this section shall apply to testing services for all concrete curb and gutter, sidewalk, slope paving, retaining walls, structures, and for all miscellaneous concrete testing. Testing for concrete pavement shall be in accordance with Chapter 5 of these STANDARDS AND SPECIFICATIONS.

The Responsible Party shall furnish the concrete necessary for casting test cylinders. The number of cylinders and tests shall be as follows:

<u>Type of Test</u>	<u>Frequency</u>
Slump	1 per set of cylinders and as often as needed for quality control
Air Content	1 per set of cylinders and as often as needed for quality control
Compressive Strength	1 set of four (4) cylinders per 100 cubic yards or major fraction thereof on each day pavement is placed; 2 cylinders to be field cured
Thickness	1 per 1250 linear feet each traffic lane on freshly finished concrete and as often as needed for quality control

The degree and frequencies of all concrete testing beyond normal specified frequencies, if

necessary to assure quality control, shall be determined by the City Representative at the time of concrete construction. The Responsible Party shall pay for all concrete testing necessary.

#### **7.11.10 Repairs**

After stripping of the forms, if any concrete is found to be not formed as shown on the drawings or is out of alignment or level or shows a defective surface, it shall be considered as not conforming with the intent of these STANDARDS AND SPECIFICATIONS and shall be removed and replaced by the Responsible Party at his expense unless the City Representative gives written permission to patch the defective area. In this case, patching shall be done as described in the following paragraphs. Defects that require replacement or repair are those that contain honeycomb, damage due to stripping of forms, loose pieces of concrete, bolt holes, tie-rod holes, uneven or excessive ridges at form joints, and bulges due to movement of the forms and other deficiencies noted in Section 10.40.06. Ridges and bulges shall be removed by grinding. Honeycombed and other defective concrete that does not affect the integrity of the structure shall be chipped out and the vacated areas shall be filled in a manner acceptable to the City Representative. The repaired area shall be patched with a non-shrink, non-metallic grout with a minimum compressive strength of five thousand (5000) psi in twenty-eight (28) days. All repair areas treated with an epoxy-bonding agent shall have the approval of the City Representative before the repair filling is placed.

Bolt holes, tie-rod holes, and minor imperfections as approved by the City Representative shall be filled with dry-patching mortar composed of one (1) part Portland cement to two (2) parts of regular concrete sand (volume measurement) and only enough water so that after the ingredients are mixed thoroughly the mortar will stick together on being molded. Mortar repairs shall be placed in layers and thoroughly compacted by suitable tools. Care shall be taken in filling rod and bolt holes so that the entire depth of the hole is completely filled with compacted mortar. The mortar mix proportions described above are approximate.

An approved mix shall be prepared by a commercial testing laboratory to insure that grout has a twenty-eight (28) day compressive strength equal to that of the area on which it is placed. The Responsible Party shall pay all costs for mix design and testing. Those areas with excessive deficiencies as determined by the City Representative shall be removed and replaced at the Responsible Party's expense. Where repairs are made in existing sidewalks, all edges of the old sidewalk allowed to remain shall be saw-cut to a minimum depth of two inches (2"). No rough edges will be permitted where new construction joins the old section. Unless directed by the City Representative, no section less than five feet (5') in length shall be placed or left in place. Where new sidewalk construction abuts existing sidewalks, the work shall be accomplished so that there is no abrupt change in grade between the old section and the new work.

### **7.20.00 MATERIAL SPECIFICATIONS**

#### **7.21.00 CONCRETE MIX DESIGN**

Concrete shall be classed according to Table 7.21.00 below. Project application of the different concrete classes shall be as follows:

Concrete Sidewalk	--	Class B (6 sack mix)
Concrete Curb and Gutter	--	Class B (6 sack mix)
Concrete Structures	--	Class A or B, or as designed
Precast Products	--	Refer to <u>Materials</u> Section of appropriate chapter

TABLE 7.21.00  
Concrete Table

	Concrete Class	<u>A</u>	<u>AX</u>	<u>B</u>	<u>(k)P</u>
L	DESIGN MINIMUM <sup>(a)</sup>				
A	COMPRESSIVE STRENGTH 28 days				
B	(45 days for Type V cement)				
O	Pounds Per Square Inch	3750	3750	3750	3750
R					
A	CEMENT CONTENT (Cement Factor)				
T	Range (Pounds Per Cubic Yard):				
O	Minimum --	550	600	550	550
R	Maximum --	600	700	600	600
Y					
	WATER CEMENT RATIO (Pounds of Water Per Pounds of Cement):	0.500	0.500	0.530	0.480
	PERCENT ENTRAINED & ENTRAPPED AIR (Total Range):	4-7	5-8	5-8	4-7
C					
O	CONSISTENCY AASHTO DESIGNATION				
A	T-119 <sup>(b)</sup> -- Range in Inches:	2-4	1-3	1-4	1-3
R					
S	AGGREGATE AASHTO DESIGNATION				
E	M-43 -- Size Number:	467	(f)	67	<u>467</u> 357
F					
I	AGGREGATE AASHTO DESIGNATION				
N	M-6 -- Percent Total Aggregate				
E	Range:	34-39	(f)	37-44	<u>34-38</u> 33-38

(a) Not a field specification requirement. The desired minimum field strength is 80 percent of the specified laboratory strength.

(b) The point of acceptance for consistency requirements will be at the mixer discharge for transit-mixed concrete.

## 7.22.00 CONCRETE MATERIALS

Concrete shall be composed of Portland cement, aggregate, and water and shall be reinforced with steel bars or steel-wire fabric where required. No admixture other than air-entraining agents shall be used without written permission of the City Representative.

### 7.22.01 Cement

Portland Cement shall conform to the requirements of the following specifications for the type specified or permitted:



<u>Type</u>	<u>Specification</u>
Portland Cement, Type I, II	ASTM C 150, AASHTO M 85
Air-Entraining Portland Cement	AASHTO M 134
Masonry Cement	AASHTO M 150

In general, Type II cement shall be used in concrete which will be in contact with the soil unless otherwise allowed or directed by the City Representative. Unless otherwise permitted by the City Representative, the product of only one (1) mill of any one brand and type of Portland cement shall be used on the project, except for reduction of any excessive air entrainment, where air-entrainment cement is used. The Responsible Party shall provide suitable means of storing and protecting the cement against dampness. Cement which for any reason has become partially set or which contains lumps of caked cement shall be rejected. Cement salvaged from discarded or used bags shall not be used. Flyash as a substitute for cement may be added only if prior approval from the City Representative is obtained. In most cases the City will not allow the use of flyash in the mix.

#### **7.22.02 Aggregate**

Aggregate for concrete shall be proportioned in conformance with Table 7.22.00 below.

##### **(A) Coarse Aggregate:**

The coarse aggregate shall consist of broken stone or gravel composed of clean, hard, tough, and durable stone and shall be free from soft, thin, elongated, or laminated pieces, disintegrated stone, clay, loam, vegetable, or other deleterious matter. Coarse aggregate for concrete shall conform to the requirements of AASHTO M 80, except that the percentage of wear shall not exceed forty-five (45) when tested in accordance with AASHTO T 96.

##### **(B) Fine Aggregate:**

Fine aggregate shall be composed of clean, hard, durable, uncoated particles of sand, free from injurious amounts of clay, dust, soft or flaky particles, loam, shale, alkali, organic matter, or other deleterious matter. Fine aggregate shall be well-graded from course to fine and, when tested by means of laboratory sieves, shall meet the grading requirements of Table 7.22.00 below.

#### **7.22.03 Water**

Water used in mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substance injurious to the finished product. Water shall be tested in accordance with and shall meet the suggested requirements of AASHTO T 26. Water known to be of potable quality may be used without test. Where the source of water is relatively shallow, the intake shall be so enclosed to exclude silt, mud, grass, or other foreign materials.

#### **7.22.04 Admixtures**

The Responsible Party shall use air-entraining admixtures for all concrete that will have exposed surfaces. The Responsible Party may elect to use another admixture provided the City Representative specifically approves the admixture. Documentary evidence of acceptability will be required when new or unknown admixtures are proposed for use. Air-entraining admixtures shall conform to the requirements of ASTM C 260.

TABLE 7.22.00  
Concrete Aggregate Gradation Table  
Percentages Passing Designated Sieves and Nominal Size Designation

	Coarse Aggregates (From AASHTO M 43)					Fine Aggregate				
	*	*				*	*	**	**	AASHTO
	No.3	No.4	No.6	No.7	No.8	No.57	No.67	No.357	No.467	M 6
Sieve Size	2" to 1"	1-1/2" to 3/4"	3/4" to 3/8"	1/2" to #4	3/8" to #8	1" to #4	3/4" to #4	2" to #4	1-1/2" to #4	#4 to #100
2-1/2"	100	.....	.....	.....	.....	.....	.....	.....	100	.....
2"	90-100	100	.....	.....	.....	.....	.....	.....	95-100	100
1-1/2"	35-70	90-100	.....	.....	.....	100	.....	.....	.....	95-100
1"	0-15	20-55	100	.....	.....	95-100	100	35-70	.....	.....
3/4"	.....	0-15	90-100	100	.....	.....	90-100	.....	35-70	.....
1/2"	0-5	.....	20-55	90-100	100	25-60	.....	10-30	.....	.....
3/8"	.....	0-5	0-15	40-70	85-100	.....	20-55	.....	10-30	100
#4	.....	.....	0-5	0-15	10-30	0-10	0-10	0-5	0-5	95-100
#8	.....	.....	.....	0-5	0-10	0-5	0-5	.....	.....	.....
#16	.....	.....	.....	.....	0-5	.....	.....	.....	.....	45-80
#50	.....	.....	.....	.....	.....	.....	.....	.....	.....	10-30
#100	.....	.....	.....	.....	.....	.....	.....	.....	.....	2-10

\* Additional primary gradings may be permitted when produced on the project provided the theoretical combination meets the specifications for combined aggregate sizes. \*\* Size No. 357 is a combination of No. 3 and No. 57. Size No. 467 is a combination of No. 4 and No.67

## 7.23.00 REINFORCING STEEL

Reinforcing steel shall conform to the requirements of the following specifications:

- |     |   |             |
|-----|---|-------------|
| (A) | Deformed and plain billet-steel bars for concrete reinforcement | AASHTO M 31 |
| (B) | Axle-steel deformed and plain bars for concrete reinforcement   | AASHTO M 53 |
| (C) | Fabricated steel bar or rod mats for concrete reinforcement     | AASHTO M 54 |
| D)  | Welded steel-wire fabric for concrete reinforcement             | AASHTO M 55 |

Unless otherwise designated, bars conforming to AASHTO M 31 and M 53 shall be furnished in Grade 60 for No. 5 bars and larger and Grade 40 or 60 for bars smaller than No. 5. In AASHTO M 54, bar material conforming to AASHTO M 42 will not be permitted.

## 7.24.00 CURING MATERIALS

Curing materials shall conform to the following requirements:

- |    |   |              |
|----|---|--------------|
| A) | Burlap cloth made from Jute or Kenaff                                   | AASHTO M 182 |
| B) | Sheet materials for curing concrete                                     | AASHTO M 171 |
| C) | Liquid membrane forming compounds for curing concrete (white pigmented) | AASHTO M 148 |

Straw used for curing shall consist of threshed straw of oats, barley, wheat, or rye. Clean field or marsh hay may be substituted when approved by the City Representative. Old dry straw or hay, which breaks readily in the spreading process, will not be permitted.

## **7.25.00 FORM WORK**

Whenever necessary, forms shall be used to confine the concrete and shape it to the required lines. Forms shall have sufficient strength to withstand, without deformation, the pressure resulting from placement and vibration of the concrete. Forms shall be constructed so that the finished concrete will conform to the shapes, lines, grades, and dimensions indicated on the approved plans. Any form which is not clean and has not had the surface prepared with a commercial form oil that will effectively prevent bonding and that will stain or soften concrete surfaces shall not be used. Plywood forms, plastic coated plywood forms, or steel forms shall be used for all surfaces requiring forming which are exposed to view, whether inside or outside any structure. Surfaces against backfilled earth, interior surfaces, of covered channels, or other places permanently obscured from view may be formed with forms having substandard surfaces.

Forms shall not be disturbed until the concrete has hardened sufficiently to permit their removal without damaging the concrete or until the forms are not required to protect the concrete from mechanical damage. Minimum time before removal of forms after placing concrete shall be one (1) day for footings and two (2) days for all other concrete except curbs, gutters, and sidewalks.

## **7.26.00 JOINTING MATERIAL**

Joint materials will conform to AASHTO specifications according to type as follows:

- |     |   |       |
|-----|---|-------|
| (A) | Concrete joint sealer, hot-poured elastic                               | M 173 |
| (B) | Performed expansion joint filler<br>(bituminous type)                   | M 33  |
| (C) | Performed sponge rubber and cork expansion<br>joint fillers             | M 153 |
| (D) | Performed expansion joint fillers (non-<br>extruding and resilient bit) | M 213 |

## **7.27.00 BATCHING AND MIXING**

### **7.27.01 General**

All concrete shall be thoroughly mixed in a batch mixer of an approved type and capacity for a period of not less than two (2) minutes after all the materials, including the water, have been placed in the drum. During the period of mixing, the drum shall be operated at the speed specified by the manufacturer of the equipment. The entire contents of the mixer shall be discharged before recharge, and the mixer shall be cleaned frequently. The concrete shall be mixed only in such quantities that are required for immediate use. No retempering of concrete will be permitted. Hand-mixed concrete will not be permitted except by written approval of the City Representative and then in only very small quantities or in case of an emergency.

### **7.27.02 Proportioning the Mix**

Proportioning the dry constituents of all concrete mixtures shall be accomplished by weighing. The supplier shall provide adequate and accurate scales for this work. There shall be no variance permitted in the minimum cement factor (sacks per cubic yard) as specified for the classes of

concrete. The total quantity of mixing water per sack of cement, including free water in the aggregate, shall not exceed the minimum specified herein. The supplier shall be responsible for developing the proper proportions of aggregates, cement, and water that will conform to the various requirements of these STANDARDS AND SPECIFICATIONS.

#### **7.27.03 Ready-Mixed Concrete**

The use of ready-mixed concrete in no way relieves the Responsible Party of the responsibility for proportion, mix, delivery, or placement of concrete. All concrete shall conform to all requirements of these STANDARDS AND SPECIFICATIONS and ASTM C 94 and AASHTO M 157.

The City shall have free access to the mixing plant at all times. The organization supplying the concrete shall have sufficient plant and transportation facilities to assure continuous delivery of the concrete at the required rate. The Responsible Party shall collect delivery or batch tickets from the driver for all concrete used on the project and deliver them to the City Representative. Batch tickets shall provide the following information:

- (A) Weight and type of cement.
- (B) Weights of fine and coarse aggregates
- (C) Weight (in gallons) of water including surface water on aggregates
- (D) Quantity (cubic yards) per batch
- (E) Times of batching and discharging of concrete
- (F) Name of batch plant
- (G) Name of Responsible Party
- (H) Type
- (I) Name and amount of admixture
- (J) Date and truck number.